

# **STEM Standards 2009-2010**

**A Draft Version for the Validation  
Process**

## SD Career Cluster Validation Process

- Secondary teachers from across the state review and comment on ‘core’ standards
- Curriculum, Technology & Assessment department review standards for technical writing and consistency
- Business & Industry & Post Secondary Instructors review courses and ‘core’ standards
- Finalize ‘Core’ Standards

*Questions or Comments  
Please Contact*

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# State Approved Course Options

	Engineering Technology		Science and Math	
Foundational	Personal Finance (22210)	Employability/Careers (22152)	Career Exploration (80023)	
CTE Courses	Foundations of CTE (22150)	Computer Applications (10004)	Service Learning (22104)	
	.5 credits of CTE Foundational courses can be counted towards the 2 credit concentrator requirement			
Cluster Courses	MS Technology Education (21050)		Introduction to Technology Education (21051)	
	MS Mechatronics/Robotics (21016)		*MS Engineering (21000)	
Pathway Courses	State Developed	Project Lead the Way	Non-CTE Science and Math Courses	
	Aerospace Technology (21017)	*Aerospace Engineering (21013)	Science	Math
	Alternate Energy Systems (21057)	*Biotechnical Engineering (21014)	Aeronautics (59502)	Calculus (58027)
	Aviation (20053)	*Civil Engineering & Architecture (21012)	Anatomy/Physiology (59106)	Geometry (58025)
	Computer Assisted Drafting (21107)	*Computer Integrated Manufacturing (21010)	Biology (59101)	Physics (59301)
	Computerized Electronics (21019)	*Digital Electronics (21008)	Biology II (59102)	Trigonometry (58028)
	Electronics (17106)	*Intro to Engineering Design (21006)	Chemistry (59201)	
	Engineering Design & Development (21007)	*Principles of Engineering (21004)	Geophysics (59505)	
	Fundamentals of Engineering (21018)	Project Lead the Way Capstone	Meteorology (59509)	
	Integrated Computer Manufacturing (21016)	*Engineering Design and Development	Physical Science (59401)	
	Intro to Energy & Power (20101)			
	Introduction to Engineering (21001)			
	Mechatronics/Robotics (21009)			
Production Systems (13101)				
Capstone Experiences	Youth Internships (80018)	Entrepreneurship Experience (80026)	Pre Apprenticeship (80020)	Senior Experience (80019)

\* Denotes Project Lead the Way Courses



# South Dakota's Definition of STEM

South Dakota STEM (Science, Technology, Engineering, & Math) education is the mastery and integration of science and mathematics with technology and engineering for ALL students through:

- Relevant educational experience that advances career goals through a Personal Learning Plan, Programs of Study, and 21<sup>st</sup> Century Skills;
- The development of relationships by connecting students, teachers, parents, schools and communities to create opportunities for success in a global economy through Career Guidance, Parental Engagement, and Service Learning;
- Utilizing rigorous curriculum, instruction and assessment to prepare students for a post-secondary experience and career opportunities;
- Data-based decisions by evaluating student progress and improving educational outcomes.

A true STEM education program integrates the four fields of Science, Technology, Engineering, & Math. STEM education incorporates scientific inquiry and technological design to develop skills through:

- communication,
- teamwork and collaboration,
- creativity and innovation,
- critical thinking and problem solving,
- while using a professional work ethic.

# Table of Contents

Course	Page
Cover	
Validation Process	i
Program Options	ii
South Dakota's Definition of STEM	iii
Table of Contents	iv
Alternate Energy Systems	1 - 7
Electronics	8 - 13
Engineering Design and Development	14 - 18
Introduction to Technology Education	19 - 24
Introduction to Energy & Power	25 - 31
Introduction to Engineering	32 - 37
Middle School Technology Education	38 - 43
Computer Aided Drafting	44 - 47
Mechatronics/Robotics	48 - 50
Middle School Mechatronics/Robotics	51 - 53

## Alternate Energy Systems

### Course Code: 21057

#### **Rationale Statement:**

Alternate Energy systems play a critical role in everyday life, and as such are an important part of engineering. This course serves as an introductory course in alternative energy. This is a survey of wind, biomass, solar, geothermal, and other non-traditional energy sources, characteristics, and application by means of projects and hands-on activity, and other experimental activities. This course also provides a close look at the “Green Automobiles” of the future.

#### **Suggested Grade Level: 10 - 12**

#### **Topics Covered:**

- History of Energy Generation
- Energy Consumption
- Energy Systems
- Environment
- Atmospheric Science & Weather

#### **Core Technical Standards & Examples**

<b>Indicator #1: Explore the history of alternative energy</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>AES.1.1 Understand the influence of energy generation on history</b></p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>• Identify various energy generation technologies throughout history</li> <li>• Analyze the significance of energy generation and the growth of society</li> <li>• Explain the relationship between energy production and public demand</li> </ul>
<b>Evaluating</b>	<p><b>AES.1.2 Evaluate the role of society in the development and use of energy generation methods</b></p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>• Evaluate the demand levels for energy usage for industrialized nations</li> <li>• Summarize the influence energy has had on developing nations</li> <li>• Summarize the influence energy systems had on technological advancements</li> </ul>

<b>Indicator #2: Investigate a basic understanding of alternative energy</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<p><b>AES.2.1 Compare and contrast energy consumption patterns</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>Analyze data to select the most appropriate technology for the given problem</li> <li>Make precise calculations and check the validity of the results from the context of the problem</li> <li>Determine the appropriate technology based upon energy consumption needs</li> </ul>
<b>Understanding</b>	<p><b>AES.2.2 Understand the key concepts of technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>State some of the energy theory behind the 'greenhouse effect'</li> <li>Analyze data to select the most appropriate technology for the given problem</li> <li>Make precise calculations and check the validity of the results from the context of the problem</li> </ul>
<b>Understanding</b>	<p><b>AES.2.3 Understand the key terms of technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>Define alternative energy</li> <li>Define renewable energy</li> <li>Define non-renewable energy</li> </ul>
<b>Understanding</b>	<p><b>AES.2.4 Explain alternative energy systems</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>Identify various wind energy systems</li> <li>State that wind energy can be used to generate electricity</li> <li>State the energy conversion taking place in a wind turbine</li> </ul>



<b>Indicator #3: Understand the energy content of major energy systems</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<b>AES.3.1 Analyze the characteristics of wind energy systems</b> Examples: <ul style="list-style-type: none"> <li>• Identify various types of wind energy systems</li> <li>• Analyze structures in wind energy systems</li> <li>• State that wind energy can be used to generate electricity</li> </ul>
<b>Analyzing</b>	<b>AES.3.2 Analyze the characteristics biomass energy systems</b> Examples: <ul style="list-style-type: none"> <li>• Identify the various types of biomass systems</li> <li>• Identify the types of biomass</li> <li>• Analyze the various processes used to convert biomass into energy</li> </ul>
<b>Analyzing</b>	<b>AES.3.3 Analyze the characteristics solar energy systems</b> Examples: <ul style="list-style-type: none"> <li>• State that solar energy can be used to generate electricity</li> <li>• State the energy conversion-taking place in solar panels</li> <li>• Analyze the environmental benefits for using solar energy systems</li> </ul>
<b>Analyzing</b>	<b>AES.3.4 Analyze the characteristics geothermal energy systems</b> Examples: <ul style="list-style-type: none"> <li>• Identify the various types of geothermal systems</li> <li>• Compare the advantages and disadvantages of using geothermal energy</li> <li>• Analyze he various processes used to convert geothermal into energy</li> </ul>
<b>Analyzing</b>	<b>AES.3.5 Analyze the characteristics traditional energy systems</b> Examples: <ul style="list-style-type: none"> <li>• Identify the correct energy flow in a nuclear power plant</li> <li>• Identify the processes involved when using nuclear energy to generate electricity</li> <li>• State the environmental benefits for using traditional energy systems</li> </ul>

<b>Indicator #4: Understand the environmental and economic cost of using alternate energy generation technologies</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>AES.4.1 Understand the environmental effects of alternate energy sources</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify how water can be used to generate electricity</li> <li>• Identify the purpose of the sub-systems within a hydroelectric Power plant</li> <li>• State that wind energy can be used to generate electricity</li> </ul>
<b>Analyzing</b>	<p><b>AES.4.2 Analyze the cultural, social economic and political effects of alternate energy sources</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify jobs provided by the alternative energy industries</li> <li>• Identify the problems associated with non-renewable energy resources</li> <li>• Identify some of the ways in which alternative energy sources are being used globally</li> </ul>

<b>Indicator #5: Understand how weather affects energy production</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>AES.5.1 Understand the effects of energy production on the environment</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify the problems associated with non-renewable energy resources</li> <li>• Identify the normal pH value of rainwater</li> <li>• Classify substances in order of acidity</li> </ul>
<b>Understanding</b>	<p><b>AES.5.2 Explain how weather effects energy production</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify some of the ways in which alternative energy sources are being used globally</li> <li>• Identify the need to preserve existing energy resources and to find new methods of providing energy</li> <li>• Indicate how the uses of fossil fuels harm the environment</li> </ul>

<b>Indicator #6: Understand the use of alternative energy systems</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>AES.6.1 Identify that energy can be produced from a variety of sources</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify two transducers used in the solar powered car</li> <li>• Identify the function of components in a model rocket</li> <li>• State the function of a solar panel transducer</li> </ul>
<b>Understanding</b>	<p><b>AES.6.2 Explain the advantages and disadvantages of alternative energy</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Build a motor support structure and powers it to lift a weight with the most appropriate power supply</li> <li>• Identify factors affecting the price of electricity</li> <li>• Analyze data to select the most appropriate technology for the given problem</li> </ul>

## Electronics

### Course Code: 17106

**Rational Statement:**

Electronics is a supporting knowledge and skill in 12 of the 16 career clusters. Electronic technology is part of our everyday lives. It is the core component and central nervous system of modern manufacturing techniques and business communications. Contemporary society depends on this technology and the evolution of applied electronics continues at an ever-increasing pace.

**Suggested Grade Level: 9-12****Topics Covered:**

- Safety
- Component usage and identification
- Calculations showing the relationship between resistance, voltage, current and power
- Circuit fundamentals

**Core Technical Standards & Examples**

<b>Indicator 1: Determine general technical literacy skills</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Applying</b>	<p><b>ELTRON1.1. Employ appropriate units and abbreviations</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Convert whole number expressions to appropriate electronics exponential expression</li> <li>• Differentiate between electronics exponential expression from scientific notation</li> <li>• Define abbreviations used in a schematic diagram</li> </ul>
<b>Applying</b>	<p><b>ELTRON1.2. Determine unknown values in multiple types of electronic circuits</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Calculate unknown electronic unit values using given or measured values</li> <li>• Apply appropriate formula to solve for unknown values in a variety of circuits</li> <li>• Apply ratings of resistors based on color bands</li> </ul>
<b>Understanding</b>	<p><b>ELTRON1.3 Identify proper terminology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify the parts of a circuit</li> <li>• List the parts of a circuit</li> <li>• Draw a parallel and series circuit</li> </ul>

<b>Indicator 2: Demonstrate proficiency in electronic safety</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Evaluating</b>	<p><b>ELTRON2.1. Determine physiological responses to electrical shock</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Classify ways electrical shock can damage the human body</li> <li>• Describe how electrical shock can cause death</li> <li>• Evaluate safety concerns in various working environments</li> </ul>
<b>Applying</b>	<p><b>ELTRON2.2. Demonstrate proper safety procedures in the use of soldering and test equipment</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Operate and use proper personal protective equipment</li> <li>• Describe methods to reduce the severity of electrical shock</li> <li>• Observe and follow all safety rules based on *OSHA standards</li> </ul> <p><i>*Occupational Safety and Health Administration</i></p>

<b>Indicator 3: Demonstrate proficiency in circuit assembly</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Creating</b>	<p><b>ELTRON3.1. Construct a circuit using schematic symbols for identified components</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Apply resistor color code to identify proper resistor values</li> <li>• Maintain proper polarity for electrolytic capacitors</li> <li>• Locate components correctly in relation to a schematic diagram</li> </ul>
<b>Creating</b>	<p><b>ELTRON3.2. Construct circuit boards using correct soldering principles and techniques</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Connect components in proper position on circuit board</li> <li>• Handle all components carefully</li> <li>• Determine proper amounts of solder to cover the connection</li> </ul>
<b>Evaluating</b>	<p><b>ELTRON3.3. Determine cause of non-operational circuits</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Troubleshoot a bread-board circuit</li> <li>• Repair a circuit board</li> <li>• Select the proper test equipment for repair of faulty circuits</li> </ul>



<b>Indicator 4: Determine proper use of test equipment</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Applying</b>	<b>ELTRON4.1. Measure resistance, voltage, and current in circuits</b>  Examples: <ul style="list-style-type: none"> <li>• Connect test leads in proper positions</li> <li>• Place meter selector switch in proper position</li> <li>• Record meter reading using correct measurement values</li> </ul>
<b>Understanding</b>	<b>ELTRON4.2. Classify equipment for signal analysis</b>  Examples: <ul style="list-style-type: none"> <li>• List equipment that provides signal outputs</li> <li>• Identify equipment that measures signals</li> <li>• Identify the various signals</li> </ul>

<b>Indicator 5: Troubleshoot circuits for proper operation</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Applying</b>	<p><b>ELTRON5.1. Calculate voltage, current, and power solutions in circuits</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Employ correct formula or law to solve for unknown values</li> <li>• Record calculated values using proper measurement values</li> <li>• Troubleshoot circuits for proper operation</li> </ul>
<b>Evaluation</b>	<p><b>ELTRON5.2. Troubleshoot solutions to analyze circuit operation</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Measure the values of components within a circuit</li> <li>• Graph calculated and measured values</li> <li>• Compare values to determine if they are within circuit parameters</li> </ul>

## Engineering Design and Development

Course Code: 21007

### **Rationale Statement:**

Engineering Design and Development is a second level course in engineering technology. Students are engaged in an instructional program that integrates academics and technical preparation and focuses on career awareness. The course outline for Engineering Design and Development could be used as an outline for a senior experience. This course is designed to provide the student with an engaging opportunity to design, innovate and develop technological artifacts (products). This course will prepare students for direct entry into a career, advanced educational opportunities, and lifelong learning.

### **Suggested Grade Level: 11-12**

### **Topics covered:**

- Problem Solving
- Conducting Research
- Analyzing Criteria
- Analyzing Research
- Decision Making
- Creating a Product
- Product Testing
- Communication
- Writing

<b>Indicator #1: Identify a technologically related problem and possible solutions</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<b>EDD.1.1 Examine current state of a problem</b>  Examples: <ul style="list-style-type: none"> <li>• Perform a needs assessment to determine relative importance of the problem</li> <li>• List pros and cons of a current problem</li> <li>• Compare current problem to similar problems</li> </ul>
<b>Applying</b>	<b>EDD.1.2 Research solution options to solve the problem</b>  Examples: <ul style="list-style-type: none"> <li>• Brainstorm possible solutions</li> <li>• Explore other options via the Internet, library, interviews, etc.</li> <li>• Conduct research by interviewing industry professionals</li> </ul>
<b>Applying</b>	<b>EDD.1.3 Propose new solutions to solve the problem</b>  Examples: <ul style="list-style-type: none"> <li>• Present a design plan</li> <li>• Formulate a course of action to solve the chosen problem</li> <li>• Discuss solution ideas with team members</li> </ul>
<b>Knowledge</b>	<b>EDD.1.4 Identify the best solution</b>  Examples: <ul style="list-style-type: none"> <li>• List the pros and cons of each solution</li> <li>• Discuss and analyze potential solutions</li> <li>• Select the best solution</li> </ul>

<b>Indicator #2: Construct a prototype of the solution to the problem</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<b>EDD.2.1 Construct a prototype to model solution</b>  Examples: <ul style="list-style-type: none"> <li>• Sketch a prototype of their product</li> <li>• Communicate product specifications</li> <li>• Construct product according to specifications</li> </ul>
<b>Applying</b>	<b>EDD.2.2 Test the prototype for effectiveness</b>  Examples: <ul style="list-style-type: none"> <li>• Create a product for safety testing</li> <li>• Collect data on prototype tests</li> <li>• Analyze the data for prototype effectiveness</li> </ul>

<b>Indicator #3: Analyze test data results for prototype performance</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Applying</b>	<b>EDD.3.1 Analyze test results</b>  Examples: <ul style="list-style-type: none"> <li>• Evaluate product performance data</li> <li>• Chart and graph data</li> <li>• Write a reflection on the test results</li> </ul>
<b>Applying</b>	<b>EDD.3.2 Make decisions based on test result data</b>  Examples: <ul style="list-style-type: none"> <li>• Identify performance needs</li> <li>• Theorize on product improvements</li> <li>• Develop concept models based on data results</li> </ul>
<b>Applying</b>	<b>EDD.3.3 Redesign the product to meet performance needs</b>  Examples: <ul style="list-style-type: none"> <li>• Sketch changes made to prototype</li> <li>• Summarize findings of prototype performance</li> <li>• Apply changes to the prototype</li> </ul>

<b>Indicator #4 Communicate solution(s) and the prototype for others</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Applying</b>	<b>EDD.4.1 Communicate solutions for the product</b>  Examples: <ul style="list-style-type: none"><li>• Create a presentation of the final product for potential clients</li><li>• Write a report for potential clients</li><li>• Modify final product options to meet client demand</li></ul>

## Introduction to Technology Education

Course Code: 21050

### Rationale Statement:

Introduction to Technology Education is a significant part of society. Most careers call for some type of technology skills. Technology education brings deeper meaning to core content concepts while introducing students to various technologies, technical skills, critical thinking processes, and hands-on experiences. Students will become technologically literate problem solvers and creative thinkers.

### Suggested Grade Level: 9-10

#### Topics Covered:

- Nature of Technology
- Technology & Society
- Design Process
- Energy & Power
- Transportation
- Manufacturing & Construction
- Communications

### Core Technical Standards & Examples



<b>Indicator #1: Analyze the scope and nature of technology</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<p><b>ITE.1.1 Examine the relationship between technology and other areas of study</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify scientific and mathematical principals relating to the construction of a product</li> <li>• Construct a technological product and identify scientific principals in the design</li> <li>• Write a short paper on how technology has impacted history</li> </ul>
<b>Understanding</b>	<p><b>ITE.1.2 Understand the effects of technology on the environment</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• List ways technology positively affects the environment</li> <li>• Identify five types of energy and a primary source of each of these energy types</li> <li>• Match the names of the various types of energy with the kind of pollution associated with it</li> </ul>
<b>Understanding</b>	<p><b>ITE.1.3 Examine the relationship between the cultural, social, economic, and political effects of technology on society</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Present information on a current topic relating to social, economic, or technological forces, explaining how technology has influenced the issue</li> <li>• Research a law involving technology and identify related cultural, social, economic, and political issues</li> <li>• Choose a favorite invention and write a short paper describing how it influenced our society</li> </ul>

<b>Indicator #2: Use the system-thinking model (the feedback loop)</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<p><b>ITE.2.1 Apply the design process</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Draw, label, and explain the components of the system-thinking model</li> <li>• Employ the system-thinking model to improve the design of a simple technological product</li> <li>• Construct the product based upon specifications</li> </ul>
<b>Applying</b>	<p><b>ITE.2.2 Apply engineering design</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Gather, organize, and interpret performance data relating to a simple technological product</li> <li>• Build a prototype design of a simple technological design</li> <li>• Produce an original design</li> </ul>

<b>Indicator #3: Solve problems using innovation, research, experimentation, and troubleshooting</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<p><b>ITE.3.1 Use research and experimentation methods to solve problems</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Contrast a non-functional system to a functional system to identify differences</li> <li>• Utilize data collection in researching design refinement</li> <li>• Design a research method to collect data</li> </ul>
<b>Applying</b>	<p><b>ITE.3.2 Use innovation and troubleshooting methods to solve problems</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Employ troubleshooting techniques to maintain a set of simple tools</li> <li>• Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it</li> <li>• Solve a problem with a given set of materials</li> </ul>

<b>Indicator #4: Apply manipulative skill sets</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<b>ITE.4.1 Understand biotechnologies</b>  Examples: <ul style="list-style-type: none"> <li>• Model a soil erosion control system</li> <li>• Design/Implement an experiment to show the difference in growing conditions</li> <li>• Produce Ethanol from biomass</li> </ul>
<b>Applying</b>	<b>ITE.4.2 Understand energy and power technologies</b>  Examples: <ul style="list-style-type: none"> <li>• Demonstrate the Law of Conservation of Energy</li> <li>• Build a model that uses one type of energy and explain how it works</li> <li>• Construct a solar collector from household items</li> </ul>
<b>Applying</b>	<b>ITE.4.3 Understand information and communication technologies</b>  Examples: <ul style="list-style-type: none"> <li>• Design a webpage</li> <li>• Develop a broadcast or presentation (audio, video, computer presentation) to inform a group of a topic</li> <li>• Depict a 3-D view drawing with CAD software</li> </ul>
<b>Applying</b>	<b>ITE.4.4 Understand transportation technologies</b>  Examples: <ul style="list-style-type: none"> <li>• Explain the different types of transportation needed to get an agricultural product from the field to the consumer</li> <li>• Create a student traffic pattern to improve the safety of student traffic around the parking lots of the high school</li> <li>• Calculate the cost differences between public and personal transportation</li> </ul>
<b>Applying</b>	<b>ITE.4.5 Understand manufacturing technologies and materials</b>  Examples: <ul style="list-style-type: none"> <li>• Create a presentation detailing the various types of manufacturing, explaining the importance of each</li> </ul>

	<ul style="list-style-type: none"> <li>• Set up a simple assembly line to produce a product</li> <li>• Market a product</li> </ul>
<b>Applying</b>	<p><b>ITE.4.6 Understand construction technologies</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Compute amount of material needed to build a structure</li> <li>• Construct the structure according to specifications</li> <li>• Test the structure</li> </ul>

## Introduction to Energy & Power

### Course Code: 20101

#### **Rationale Statement:**

Introduction to Energy & Power is used every day in many different ways. To become a more environmentally friendly society, students will have a basic understanding of the various types of energy and how energy is obtained. Everyone should know what energy sources are available that do not pollute the environment and how this energy can be converted into a useful power supply.

**Suggested Grade Level: 9-10**

#### **Topics Covered:**

- History and effects on society
- Relationship between work, energy, and power
- Transmission of power
- Alternative power
- Safety

#### **Core Technical Standards & Examples**

<b>Indicator #1: Analyze the history of energy/power sources and their effect on society</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<b>EP.1.1 Examine the historical development of energy/power production</b>  Examples: <ul style="list-style-type: none"> <li>• Develop a timeline depicting the development of engines</li> <li>• Write a paper on a famous inventor</li> <li>• Give an oral report on the development of a power system</li> </ul>
<b>Analyzing</b>	<b>EP.1.2 Assess the impact of energy/power on the way we live and work</b>  Examples: <ul style="list-style-type: none"> <li>• List various energy sources and machines used prior to the 21<sup>st</sup> century</li> <li>• Select an invention and write a short paper describing its impact on society, both positive and negative</li> <li>• Examine how the past use of energy and machines has negatively impacted our planet</li> </ul>

<b>Indicator #2: Examine the relationship between work, energy, and power</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<b>EP.2.1 Define work, power, and energy</b> Examples: <ul style="list-style-type: none"> <li>• Define work</li> <li>• Recall the formula for power</li> <li>• Describe energy</li> </ul>
<b>Analyzing</b>	<b>EP.2.2 Examine the relationship between power sources</b> Examples: <ul style="list-style-type: none"> <li>• Describe the difference between weight, mass, and force</li> <li>• Use equations to find missing information pertaining to work, energy and power</li> <li>• Compute the efficiency of a machine</li> </ul>



<b>Indicator #3: Understand the transmission of energy &amp; power</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<b>EP.3.1 Understand how a mechanical system operates</b>  Examples: <ul style="list-style-type: none"> <li>• Classify power trains as being either direct or indirect</li> <li>• List the various parts of a power train</li> <li>• Identify the parts of a power train</li> </ul>
<b>Applying</b>	<b>EP.3.2 Understand the types of simple machines</b>  Examples: <ul style="list-style-type: none"> <li>• Construct an example of a simple machine</li> <li>• Classify the various types of levers and give an example of each</li> <li>• Compute the mechanical advantage of various simple machines</li> </ul>
<b>Understanding</b>	<b>EP.3.3 Understand both liquid and gas forms of power transmission</b>  Examples: <ul style="list-style-type: none"> <li>• List the various forms of fluid power</li> <li>• Examine results from actions applied on liquids and gases</li> <li>• Understand the laws that govern fluids</li> </ul>
<b>Understanding</b>	<b>EP.3.4 Understand the laws that govern electricity</b>  Examples: <ul style="list-style-type: none"> <li>• State Ohm's Law</li> <li>• Match symbols to quantities</li> <li>• Define electrical quantities</li> </ul>

<b>Indicator #4: Understand alternative energy</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<b>EP.4.1 Understand the sources of alternative energy</b>  Examples: <ul style="list-style-type: none"> <li>• Compare and contrast the types of alternative energy sources</li> <li>• Prepare a presentation on synthetic fuels</li> <li>• List possible alternative energy sources</li> </ul>
<b>Analyzing</b>	<b>EP.4.2 Analyze the sources alternative of energy</b>  Examples: <ul style="list-style-type: none"> <li>• Explain the environmental pros and cons for any one of the alternative energy sources</li> <li>• Present an oral presentation over one of the alternative energy sources</li> <li>• Construct a model of an alternative energy apparatus</li> </ul>

<b>Indicator #5: Implement safety with power technology</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<b>EP.5.1 Examine safety issues relating to mechanical systems</b>  Examples: <ul style="list-style-type: none"> <li>• Follow safety rules relating to moving mechanical systems</li> <li>• Explain the proper method of lifting</li> <li>• Observe and follow all lab safety rules</li> </ul>
<b>Applying</b>	<b>EP.5.2 Employ safety practices with fluids</b>  Examples: <ul style="list-style-type: none"> <li>• Follow all safety rules relating to high-pressure lines</li> <li>• Demonstrate the proper cleanup method for fluids</li> <li>• Know proper storage methods for flammable/toxic liquids</li> </ul>
<b>Understanding</b>	<b>EP.5.3 Identify fire classification and extinguishers</b>  Examples: <ul style="list-style-type: none"> <li>• Identify the types of fires</li> <li>• List which extinguisher will fight which type of fire</li> <li>• Identify the locations of fire extinguishers in the lab</li> </ul>
<b>Applying</b>	<b>EP.5.4 Employ safety practices with electricity</b>  Examples: <ul style="list-style-type: none"> <li>• Operate and use proper personal protective equipment</li> <li>• Follow all safety rules based on <i>Occupational Safety and Health Administration</i> standards</li> <li>• Develop policies for the lab based on various emergency situations</li> </ul>

<b>Indicator #6: Understand scientific concepts for energy &amp; power technology</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>EP.6.1 Understand how energy converts from one form to another</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Recall the concept of the Law of Conservation of Energy</li> <li>• Differentiate between potential and kinetic energy</li> <li>• Identify the sources of energy</li> </ul>
<b>Understanding</b>	<p><b>EP.6.2 Understand the categories of energy.</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Classify the various energy sources</li> <li>• Recall the various methods of transferring energy</li> <li>• Identify how various energy sources are used</li> </ul>
<b>Understanding</b>	<p><b>EP.6.3 Understand that an engine performing work does exhaust thermal energy that cannot be retrieved to the surroundings</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Compare the efficiency of various types of light bulbs</li> <li>• Compare the efficiency for multiple energy sources</li> <li>• Define the Law of Thermodynamics</li> </ul>
<b>Understanding</b>	<p><b>EP.6.4 Understand that energy sources can be renewable and non-renewable</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Provide examples of renewable energy sources</li> <li>• Provide examples of nonrenewable energy sources</li> <li>• List methods that are being used to conserve energy</li> </ul>

## Introduction to Engineering

### Course Code: 21001

#### **Rationale Statement:**

The Introduction to Engineering course is designed to provide a foundation in engineering for students in South Dakota. Students are engaged in an instructional program that integrates academics and technical preparation and focuses on career awareness. This course will prepare students for advanced educational opportunities.

#### **Suggested Grade Level: 9-12**

#### **Topics covered:**

- Exploring the field of engineering
- Materials and processes used in engineering
- Systems used in engineering
- Effective communication

<b>Indicator #1: Explore the fields of engineering</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<b>IE.1.1 Examine the evolution of engineering</b>  Examples: <ul style="list-style-type: none"> <li>Analyze the influence of engineering on history</li> <li>Compare and contrast two different fields of engineering</li> <li>Develop a time line of major engineering developments</li> </ul>
<b>Understanding</b>	<b>IE.1.2 Identify the types of engineers.</b>  Examples: <ul style="list-style-type: none"> <li>Develop a job description of an engineer</li> <li>Describe the work of different types of engineers</li> <li>Participate in a field trip observing the activities of an engineer</li> </ul>
<b>Understanding</b>	<b>IE.1.3 Describe the engineering team.</b>  Examples: <ul style="list-style-type: none"> <li>Describe the duties of the members of the engineering team</li> <li>Identify the proper sequence of duties, as they relate to the engineering team</li> <li>State the proper sequence of duties, as they relate to the engineering team</li> </ul>

<b>Indicator #2: Investigate various engineering systems</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Understanding</b>	<p><b>IE.2.1 Identify the various types of engineering systems</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Define each engineering system and give an example for each</li> <li>• Match engineering systems to common processes</li> <li>• List the components of an engineering system</li> </ul>
<b>Applying</b>	<p><b>IE.2.2 Apply engineering systems to solve problems</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Construct circuits from a schematic diagram</li> <li>• Assemble a mechanical system from visual or written instructions</li> <li>• Build a device to control the temperature in an enclosure</li> </ul>

<b>Indicator #3: Apply the engineering process to a product</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Applying</b>	<b>IE.3.1 Design a product</b> Examples: <ul style="list-style-type: none"> <li>• Generate thumbnail sketches to create ideas</li> <li>• Prepare a three view orthographic projection of a design</li> <li>• Create a design of a doghouse using CAD</li> </ul>
<b>Applying</b>	<b>IE.3.2 Construct a 3-D model</b> Examples: <ul style="list-style-type: none"> <li>• Build a scale model</li> <li>• Use a 3-D printer to explore form, function, and feel</li> <li>• Construct a 3-D floor plan</li> </ul>
<b>Applying</b>	<b>IE.3.3 Build and test a prototype</b> Examples: <ul style="list-style-type: none"> <li>• Expose and use the prototype in real-world conditions</li> <li>• Conduct a feasibility study on the prototype</li> <li>• Collect data generated from testing the prototype</li> </ul>
<b>Applying</b>	<b>IE.3.4 Develop a system to produce a final product</b> Examples: <ul style="list-style-type: none"> <li>• Design an assembly line that would effectively and efficiently produce a final product</li> <li>• Create a process that would allow for product development</li> <li>• Create a flow chart demonstrating the product development process</li> </ul>



<b>Indicator #4: Demonstrate effective communication</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Applying</b>	<p><b>IE.4.1 Demonstrate effective oral communication</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Present a speech that addresses environmental issues related to engineering</li> <li>• Effectively communicate with group members to brainstorm while solving a problem</li> <li>• Communicate the importance of each step in the engineering design process through an oral presentation</li> </ul>
<b>Applying</b>	<p><b>IE.4.2 Demonstrate effective written communication</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Write a report summarizing how an engineering system works</li> <li>• Create a set of directions to assemble a product</li> <li>• Research and write a newspaper editorial stating your view on a controversial engineering issue</li> </ul>
<b>Applying</b>	<p><b>IE.4.3 Demonstrate effective graphic communication</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Use PowerPoint to present an idea for a product to the class</li> <li>• Design and publish documents using advanced publishing software and graphic programs</li> <li>• Present prototype data to the class using charts and graphs</li> </ul>

<b>Indicator #5: Examine materials and testing procedures used in engineering</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standards and Examples</b>
<b>Analyzing</b>	<b>IE.5.1 Analyze materials based on their properties</b> Examples: <ul style="list-style-type: none"> <li>• Compare and contrast materials used in engineering</li> <li>• Evaluate availability of materials</li> <li>• Assess cost of materials</li> </ul>
<b>Analyzing</b>	<b>IE.5.2 Analyze material testing procedures</b> Examples: <ul style="list-style-type: none"> <li>• Examine the physical factors of the material(s)</li> <li>• Compare the cost factor(s) for various testing processes</li> <li>• Perform Brinell Hardness test on materials</li> </ul>

## Middle School Technology Education

### Course Code: 21050

#### **Rationale Statement:**

Middle School Technology Education is a significant part of society. Most careers call for some type of technology skills. Technology education brings deeper meaning to core content concepts while introducing students to various technologies, technical skills, critical thinking processes, and hands-on experiences. Students will become problem solvers and creative thinkers who are more prepared to enter secondary education ready to make informed choices about future career possibilities.

#### **Suggested Grade Level: 6-8**

#### **Topics Covered:**

- nature of technology
- technology & society
- design process
- energy & power
- transportation
- manufacturing & construction
- communications technologies

#### **Core Technical Standards & Examples**

<b>Indicator #1: Understand the scope and nature of technology</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<b>TEMS.1.1 Identify the core concepts and characteristics of technology</b>  Examples: <ul style="list-style-type: none"> <li>• Define technology and provide examples</li> <li>• List characteristics describing technology</li> <li>• Cite examples of the characteristics of technology in daily life</li> </ul>
<b>Understanding</b>	<b>TEMS.1.2 Understand the core relationships between technology and other areas of study</b>  Examples: <ul style="list-style-type: none"> <li>• Identify technological systems that interconnect</li> <li>• List products or systems that have been applied to other settings</li> <li>• Give examples of how transferred knowledge impacted the development of other technologies</li> </ul>

<b>Indicator #2: Analyze the affect of technology on society and the environment</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Analyzing</b>	<p><b>TEMS.2.1 Analyze the effects of technology on the environment</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Describe how and why the management of wastes produced by the use of technology is an important issue in society</li> <li>• Compare and contrast renewable and alternative energy resources</li> <li>• Explain how technologies can be used to repair damage caused by natural disasters</li> </ul>
<b>Analyzing</b>	<p><b>TEMS.2.2 Examine the relationship among the cultural, social, economic, and political effects of technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Describe how new technologies have resulted from the demands of society</li> <li>• Analyze how society responds to the use of new technologies</li> <li>• Research a law that was proposed based on a technological advancement</li> </ul>
<b>Analyzing</b>	<p><b>TEMS.2.3 Examine how technology has influenced history</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify inventors and research new technologies of different time periods</li> <li>• Diagram the time line of the development of a technology and link to other historical events</li> <li>• Trace and invention from the inventor to current applications, identifying the reasons for changes to the product or system</li> </ul>

<b>Indicator #3: Apply problem-solving strategies demonstrating use of the design process</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>TEMS.3.1 Understand the components of the design process</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Describe how design is a planning process that leads to useful products and systems</li> <li>• Design, construct, and assess the effectiveness of a wheeled vehicle</li> <li>• Review existing products and suggest ways to improve upon the design</li> </ul>
<b>Applying</b>	<p><b>TEMS.3.2 Apply the engineering design process</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Produce an original design that meets a set of specifications</li> <li>• Build a prototype of a simple technological design</li> <li>• Gather, organize, and calculate performance data relating to a simple technological product</li> </ul>
<b>Applying</b>	<p><b>TEMS.3.3 Apply the design process</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Refine a design by using modeling and prototypes to improve quality, efficiency, and productivity of the final product</li> <li>• Analyze criteria and constraints and determine how these will affect the design process</li> <li>• Identify a solution to a design problem</li> </ul>

<b>Indicator #4: Understand technology</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<p><b>TEMS.4.1 Understand agricultural and related biotechnology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify how agriculture is being used in medicine and other fields</li> <li>• Construct a model to show how run-off or natural disasters affect the land</li> <li>• Research current trends in biotechnology and make recommendations on appropriate use of technology</li> </ul>
<b>Understanding</b>	<p><b>TEMS.4.2 Understand energy and power technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify types of simple machines and how they affect force on an object</li> <li>• Explain the Law of Conservation of Energy</li> <li>• Identify the use of alternative energy sources locally</li> </ul>
<b>Understanding</b>	<p><b>TEMS.4.3 Understand information and communication technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Record a broadcast to inform or educate others</li> <li>• Create a web page for publication</li> <li>• Create an animation project</li> </ul>

<p><b>Understanding</b></p>	<p><b>TEMS.4.4 Understand transportation technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify on a map the major transportation routes in the local community</li> <li>• Explain the different types of transportation needed to move a product from the manufacturer to the consumer</li> <li>• Create a student traffic pattern to improve safety of student traffic in the halls of the middle school</li> </ul>
<p><b>Understanding</b></p>	<p><b>TEMS.4.5 Understand manufacturing technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Outline the various types of manufacturing, explaining the importance of each</li> <li>• Set up a simple assembly line to produce a product</li> <li>• Create a simple product out of household materials</li> </ul>
<p><b>Understanding</b></p>	<p><b>TEMS.4.6 Understand construction technology</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify hand tools by name and give uses for each</li> <li>• Identify and explain safety requirements of various tools used in construction</li> <li>• Use hand tools to assemble a household object</li> </ul>



## Computer Aided Drafting

Course Code: 21107

### **Rationale Statement:**

Computer Aided Drafting allows people with careers in design and pre-construction create our future. They turn a concept into a set of plans whether it is a component, a system, or a building. Their plans guide other construction or manufacturing professionals as they continue the building process. Students use Computer Aided Drafting software used by a skilled draftsman or engineers.

**Suggested Grade Level:** 10-12

### **Topics Covered:**

- CAD Basic Operations
- Illustrate layers
- Create blocks and attributes
- 3D drawings
- Orthographic projections
- Drawing and Plotting drawings to scale
- Math and Reading skills

**Core Technical Standards & Examples**

<b>Indicator #1 Apply design principles of CAD</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Understanding</b>	<b>CAD1.1. Identify technical design applications of CAD</b>  Examples: <ul style="list-style-type: none"> <li>• Describe benefits of design using CAD</li> <li>• Describe factors that should be included in selecting technical drafting software</li> <li>• Compare various technical drawings from assorted CAD software</li> </ul>
<b>Applying</b>	<b>CAD1.2. Apply preferences to set up a drawing in CAD</b>  Examples: <ul style="list-style-type: none"> <li>• Modify the workspace for individual users</li> <li>• Organize files for easy folder navigation</li> <li>• Set up grids and coordinates for assigned projects</li> </ul>
<b>Applying</b>	<b>CAD1.3. Use proper CAD terminology.</b>  Examples: <ul style="list-style-type: none"> <li>• Prepare a report about the area of study</li> <li>• Design a questionnaire to for an interview</li> <li>• Write a biography about a historic person in the field</li> </ul>

<b>Indicator #2 Apply computer skills to develop technical 2-D drawings</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Applying</b>	<b>CAD2.1. Apply multi-view and orthographic projections</b> Examples: <ul style="list-style-type: none"> <li>• Design top, front, and right side views of an object</li> <li>• Integrate proper dimensioning techniques on a 2-D drawing</li> <li>• Formulate the number of views needed to fully describe an object</li> </ul>
<b>Applying</b>	<b>CAD2.2. Illustrate layers with appropriate characteristics</b> Examples: <ul style="list-style-type: none"> <li>• Apply layers to a map or plot plan</li> <li>• Classify blocks or symbols to independent layers</li> <li>• Complete drawing features using various layer colors and line types</li> </ul>
<b>Understanding</b>	<b>CAD2.3. Define dimensioning styles and techniques on metric and imperial drawings</b> Examples: <ul style="list-style-type: none"> <li>• Label measurements, notes, and symbols to orthographic views</li> <li>• Identify <i>American National Standards Institute</i> standards for dimensioning and notes</li> <li>• Show drawing using metric units</li> </ul>
<b>Applying</b>	<b>CAD2.4. Create blocks and assign attributes to various projects</b> Examples: <ul style="list-style-type: none"> <li>• Integrate various symbols used on an architectural or technical drawing</li> <li>• Compose a title block with assigned attributes</li> <li>• Rearrange and edit attributes of developed blocks</li> </ul>
<b>Applying</b>	<b>CAD2.5. Illustrate isometric and pictorial drawings</b> Examples: <ul style="list-style-type: none"> <li>• Show renderings on a pictorial drawing</li> <li>• Complete an isometric from a multi-view drawing</li> <li>• Rearrange attributes of multi-view drawing</li> </ul>

<b>Indicator #3 Apply computer skills to produce technical 3-D drawings</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Creating</b>	<b>CAD3.1. Create 3-D drawings using CAD</b> Examples: <ul style="list-style-type: none"> <li>• Complete a basic 3-D solid of various geometric shapes</li> <li>• Illustrate 2-D projections of a 3-D object</li> <li>• Apply poly-lines to develop 3-D solid</li> </ul>

<b>Indicator #4 Produce final technical plans through various printing techniques</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Examples</b>
<b>Creating</b>	<b>CAD4.1. Create drawings to scale</b> Examples: <ul style="list-style-type: none"> <li>• Modify and plot drawings using all <i>American National Standards Institute</i> standard media</li> <li>• Formulate various line weights using pen assignments</li> <li>• Create a 3-D solid model on a 3-D printer</li> </ul>

# Mechatronics/Robotics

Course Code: 21009

## Rational Statement:

Mechatronics/ Robotics is the new industrial discipline for understanding how complex systems integrate various elements in the mechanical, fluid power, and controls domain, combined with the ability to work in a team environment with people of different areas of expertise.

**Suggested Grade Level:** 9-12

## Topics Covered:

- Fluid power
- Basic motor controls
- Robotics and automation
- Security
- Circuit design
- Mechanical systems
- Mechatronics
- Career Possibilities

## Core Technical Standards & Examples

<b>Indicator 1: Classify equipment in the chosen topic area(s)</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Evaluation</b>	<p><b>RBMT1.1. Demonstrate knowledge of equipment used in topic area(s)</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify type of equipment used in topic area(s)</li> <li>• List industry applications</li> </ul>
<b>Analysis</b>	<p><b>RBMT1.2. Examine the systems relationships</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Identify subsystems</li> <li>• Explain purpose of subsystems</li> </ul>

<b>Indicator 2: Access and demonstrate safety proficiency in topic area(s)</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Evaluation</b>	<p><b>RBTMT2.1. Demonstrate proper safety procedures</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Operate and use proper personal protective equipment.</li> <li>• Observe and follow all safety rules based upon <i>Occupational Safety and Health Administration</i> standards</li> </ul>
<b>Evaluation</b>	<p><b>RBTMT2.2. Determine how to apply Lockout – Tag-out procedure</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Examine process</li> <li>• List hazard areas</li> </ul>
<b>Evaluation</b>	<p><b>RBTMT2.3. Classify Materials Safety Data Sheet (MSDS)</b></p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Prepare labels and material safety data sheets (MSDS) to convey the hazard information</li> <li>• Handle all chemicals appropriately</li> </ul>

<b>Indicator 3: Construct, analyze and troubleshoot circuits</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Synthesis</b>	<b>RBMT3.1. Build a circuit according to schematic diagram</b>  Examples: <ul style="list-style-type: none"> <li>• Chose proper components</li> <li>• Assemble a circuit in accordance with schematic diagram</li> </ul>
<b>Application</b>	<b>RBMT3.2. Calculate circuit parameters</b>  Examples: <ul style="list-style-type: none"> <li>• Employ correct formula or law to solve for unknown parameters.</li> <li>• Record calculated parameters using proper measurement parameters</li> </ul>
<b>Evaluation</b>	<b>RBMT3.3. Measure circuit's parameters</b>  Examples: <ul style="list-style-type: none"> <li>• Select and use proper test equipment to measure required parameters</li> <li>• Record calculated parameters using proper measurement parameters</li> </ul>
<b>Evaluation</b>	<b>RBMT3.4. Compare calculated and measured solutions to analyze circuit operation</b>  Examples: <ul style="list-style-type: none"> <li>• Graph calculated and measured parameters</li> <li>• Compare parameters to determine if they are within circuit parameters</li> </ul>
<b>Analysis</b>	<b>RBMT3.5 Examine Proper Terminology and Career Possibilities</b>  Examples: <ul style="list-style-type: none"> <li>• Prepare a report about the area of study</li> <li>• Design a questionnaire for an interview</li> </ul>

## Middle School Robotics/Mechatronics

Course Code: 21016

### Rational Statement:

Robotics/Mechatronics exposes students to 21<sup>st</sup> century workplace skills and provides students with hands-on application of math and science concepts utilized in the real world.

**Suggested Grade Level:** 6-8

### Topics Covered:

- Basic motor controls
- Solving Worldly Problems Using Robotics
- Basic Programming
- Mechanical systems
- Robotics and Entrepreneurship
- Career Possibilities

### Core Technical Standards & Examples

<b>Indicator 1: Understand the components that make up a robot</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Understanding</b>	<b>RMMS1.1. Know the equipment used in robotics</b> Examples: <ul style="list-style-type: none"> <li>• Identify types of sensors</li> <li>• Explain various functions of motors</li> <li>• Explain the role of a computer as a robotic control device</li> </ul>
<b>Understanding</b>	<b>RMMS1.2. Identify various mechanical systems used in robotics</b> Examples: <ul style="list-style-type: none"> <li>• Describe a belt and pulley speed reduction system</li> <li>• Recognize the importance and application of mechanical advantages</li> </ul>
<b>Applying</b>	<b>RMMS1.3. Demonstrate the use of programming commands</b> Examples: <ul style="list-style-type: none"> <li>• Compile a program to demonstrating a robotic “dance”</li> <li>• Develop a program to move the robot along a particular shape</li> </ul>



<b>Indicator 2: Investigate the impact of robotics on our society</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Analyzing</b>	<b>RMMS2.1. Compare and contrast robotics labor vs. human labor</b>  Examples: <ul style="list-style-type: none"> <li>• Explain the economic advantages/disadvantages of robotic labor</li> <li>• Evaluate the decision of hiring 4 humans vs. 1 robot to do the same job</li> </ul>
<b>Understanding</b>	<b>RMMS2.2. Explore career outlook for robotic applications</b>  Examples: <ul style="list-style-type: none"> <li>• Identify jobs that will be created/eliminated by robotics</li> <li>• Brainstorm new robotics related careers</li> </ul>
<b>Understanding</b>	<b>RMMS2.3. Explore new entrepreneurial opportunities using robotics</b>  Examples: <ul style="list-style-type: none"> <li>• Discuss a fictitious business venture utilizing robotic labor</li> <li>• Identify a business that could be improved using a robotic system</li> </ul>

<b>Indicator 3: Design a robot to solve a particular problem</b>	
<b>Bloom's Taxonomy Level</b>	<b>Standard and Example</b>
<b>Applying</b>	<b>RMMS3.1. Identify robotic applications</b> Examples: <ul style="list-style-type: none"> <li>• In group discussion: consider the application of robotics</li> <li>• Draw a robot and discusses the various differences in drawings</li> </ul>
<b>Applying</b>	<b>RMMS3.2. Propose a robotic design</b> Examples: <ul style="list-style-type: none"> <li>• Sketch a diagram of a robotic “disk jockey”</li> <li>• Present an idea to the class of how a robot can make your quality of life better</li> </ul>
<b>Applying</b>	<b>RMMS3.3. Construct a robot</b> Examples: <ul style="list-style-type: none"> <li>• Build a Lego robot</li> <li>• Use an Erector set to construct a robot</li> </ul>
<b>Applying</b>	<b>RMMS3.4. Program a robot</b> Examples: <ul style="list-style-type: none"> <li>• Write and download a program to make a robot navigate through a maze</li> <li>• Write a program to make a robot follow a black line</li> </ul>
<b>Applying</b>	<b>RMMS3.5. Evaluate robot programming</b> Examples: <ul style="list-style-type: none"> <li>• Record data on the preciseness of a program</li> <li>• Analyze inconsistencies in the completion of a particular repetitive task</li> </ul>